

IN THE CLAIMS:

- 1 1. (Original) A traffic shaper for use in determining transmission start times for network
2 messages, the traffic shaper comprising:
3 a plurality of queues for storing information relating to the network messages;
4 a queue controller operably coupled to the plurality of queues for storing the in-
5 formation in and retrieving the information from the plurality of queues;
6 a scheduler in communicating relationship with the queue controller, the sched-
7 uler configured to compute release times for the network messages;
8 a memory for storing the computed release times; and
9 a memory controller operably coupled to the memory, the memory controller con-
10 figured to search the memory for computed release times,
11 wherein release times are computed and stored in the memory as information re-
12 lating to the network messages is retrieved from the queues.
- 1 2. (Original) The traffic shaper of claim 1 wherein the information includes a network
2 message length and a network message pointer.
- 1 3. (Original) The traffic shaper of claim 1 wherein each network message is associated
2 with a shaper identification (SID) value, and the traffic shaper further comprises a queue
3 control memory accessible by the queue controller, the queue control memory including a
4 mapping of SID values to queues such that the information for a given network message
5 is mapped by the SID value associated with the given message to a specific queue.
- 1 4. (Original) The traffic shaper of claim 3 wherein the queue control memory further in-
2 cludes data for each queue indicating whether the respective queue is empty.

1 5. (Original) The traffic shaper of claim 4 wherein the scheduler comprises a rate monitor
2 configured to determine a rate at which network messages can be released, and a release
3 timestamp generator for computing release times based on the determined rates.

1 6. (Original) The traffic shaper of claim 5 wherein the determined network message re-
2 lease rates are one of Committed Information Rate (CIR) and Excess Information Rate
3 (EIR) values.

1 7. (Currently Amended) The traffic shaper of claim 3 wherein the memory comprises at
2 least one content addressable memory structure for storing computed release times, and
3 corresponding a random access memory structure for storing the SID values associated
4 with the respective release times stored in the content addressable memory structure.

1 8. (Original) The traffic shaper of claim 7 wherein the memory controller comprises a
2 retrieve time generator for producing retrieve times that are used to search the computed
3 release times stored in the content addressable memory structure.

1 9. (Original) The traffic shaper of claim 8 further comprising a current time generator for
2 producing a current time, wherein the retrieve time produced by the retrieve time genera-
3 tor can catch up to but not exceed the current time produced by the current time genera-
4 tor.

1 10. (Original) The traffic shaper of claim 9 wherein upon identifying a release time stored
2 in the content addressable memory that matches the release time produced by the release
3 time generator, the memory controller provides the SID value associated with the match-
4 ing release time and the current time to the queue controller.

1 11. (Original) The traffic shaper of claim 10 wherein the queue controller, upon receiving
2 a SID value from the memory controller, accesses the queue control memory to identify

3 the queue corresponding to the received SID value, and retrieves the information from the
4 head of identified queue, thereby releasing the corresponding network message from the
5 traffic shaper.

1 12. (Original) The traffic shaper of claim 1 configured to support multiple levels of shap-
2 ing.

1 13. (Original) A method for shaping network traffic by selectively releasing network
2 messages, the method comprising the steps of:

3 providing a plurality of queues for storing data;
4 associating each queue with a corresponding shaper identification (SID) value;
5 receiving information related to a network message to be shaped, including a SID
6 value;
7 storing at least some of the received information at the queue corresponding to the
8 received SID value;
9 computing a release time for each queue containing network message informa-
10 tion;
11 storing the computed release times in a time-searchable memory structure; and
12 upon expiration of a computed release time, dequeuing network message informa-
13 tion from the queue corresponding to the expired release time.

1 14. (Original) The method of claim 13 wherein a new release time is computed for a
2 given queue in response to the step of dequeuing network message information from the
3 given queue.

1 15. (Original) The method of claim 14 further comprising the step of searching the time
2 searchable memory structure for expired release times.

1 16. (Original) The method of claim 15 wherein the network message information stored
2 at the queues includes a message length and a message pointer.

1 17. (Original) The method of claim 14 further comprising the steps of:
2 associating each computed release time stored in the time-searchable memory
3 structure with a corresponding SID value; and
4 upon expiration of a computed release time stored in the time-searchable memory
5 structure, using the associated SID value to identify the queue from which network mes-
6 sage information is to be dequeued.

1 18. (Original) The method of claim 17 wherein the step of computing a release time com-
2 prises the steps of:
3 determining, based on a rate at which network messages are being drained,
4 whether an excess information rate (EIR) or a committed information rate (CIR) is to be
5 used in the calculation; and
6 computing the release time based on the EIR or CIR as determined.

1 19. (Original) The method of claim 18 wherein the step of determining comprises the
2 steps of:
3 computing a level at which network messages are draining from the respective
4 queue;
5 comparing the level to a threshold;
6 if the new last updated level exceeds the threshold, selecting the CIR; and
7 if the new last updated level does not exceed the threshold, selecting the EIR.

1 20. (Original) The method of claim 19 further comprising the step of, upon dequeuing
2 network message information from a first queue in response to an expired release time,
3 enqueueing the network message information at a second queue.

1 21. (Original) A traffic shaper for use in determining transmission start times for network
2 messages, the traffic shaper comprising:

3 a plurality of queues for storing information relating to the network messages;
4 means for storing the information in and retrieving the information from the plu-
5 rality of queues;

6 means for computing release times for the network messages;

7 a memory for storing the computed release times; and

8 means for searching the memory for computed release times,

9 wherein release times are computed and stored in the memory as information re-
10 lating to the network messages is retrieved from the queues.

1 22. (Original) The traffic shaper of claim 21 wherein the release time computing means
2 comprises means for determining a rate at which network messages can be released, and
3 the release time computing means computes release times based on the determined rates.

1 23. (Original) The traffic shaper of claim 22 wherein the searching means comprises
2 means for producing retrieve times that are used to search the computed release times
3 stored in the memory.

1 24. (Original) The traffic shaper of claim 23 further comprising means for generating a
2 current time, wherein the retrieve time from the retrieve time producing means can catch
3 up to but not exceed the current time produced by the current time generator.

1 25. (Original) A computer readable medium containing executable program instructions
2 for shaping network traffic by selectively releasing network messages, the executable
3 program instructions comprising program instructions for:

4 providing a plurality of queues for storing data;

5 associating each queue with a corresponding shaper identification (SID) value;

6 receiving information related to a network message to be shaped, including a SID
7 value;
8 storing at least some of the received information at the queue corresponding to the
9 received SID value;
10 computing a release time for each queue containing network message informa-
11 tion;
12 storing the computed release times in a time-searchable memory structure; and
13 upon expiration of a computed release time, dequeuing network message informa-
14 tion from the queue corresponding to the expired release time.

1 26. (Currently Amended) The computer readable medium of claim ~~13~~ 25 wherein a new
2 release time is computed for a given queue in response to the step of dequeuing network
3 message information from the given queue.

1 27. (Currently Amended) The computer readable medium of claim ~~14~~ 26 further compris-
2 ing programming instructions for searching the time searchable memory structure for ex-
3 pired release times.

1 28. (Currently Amended) The computer readable medium of claim ~~15~~ 27 wherein the
2 network message information stored at the queues includes a message length and a mes-
3 sage pointer.

1 29. (Currently Amended) The computer readable medium of claim ~~14~~ 26 further compris-
2 ing programming steps for:

3 associating each computed release time stored in the time-searchable memory
4 structure with a corresponding SID value; and
5 upon expiration of a computed release time stored in the time-searchable memory
6 structure, using the associated SID value to identify the queue from which network mes-
7 sage information is to be dequeued.

1 30. (Original) The computer readable medium of claim 29 wherein the programming in-
2 struction for computing a release time comprises programming instructions for:
3 determining, based on a rate at which network messages are being drained,
4 whether an excess information rate (EIR) or a committed information rate (CIR) is to be
5 used in the calculation; and
6 computing the release time based on the EIR or CIR as determined.

1 31. (Original) The computer readable medium of claim 30 wherein the programming in-
2 structions for determining comprises the programming instructions for:
3 computing a level at which network messages are draining from the respective
4 queue;
5 comparing the level to a threshold;
6 if the new last updated level exceeds the threshold, selecting the CIR; and
7 if the new last updated level does not exceed the threshold, selecting the EIR.

1 32. (Original) The computer readable medium of claim 31 further comprising program-
2 ming instructions for, upon dequeuing network message information from a first queue in
3 response to an expired release time, enqueueing the network message information at a sec-
4 ond queue.